CLAIMS

1. A propylene random copolymer satisfying the following requirements [1] to [4]:

[1] the concentration (Pa, % by mole) of a skeletal constituent derived from propylene (a), and the concentration (Px, % by mole) of a skeletal constituent derived from at least one olefin selected from ethylene (b) and α-olefins having 4 to 20 carbon atoms (c), each of which is contained in the propylene random copolymer, satisfy the following relational expressions (Eq-1) to (Eq-3):

$$85 \leq Pa < 100 \quad \text{(Eq-1)}$$

$$0 < Px \leq 15 \quad \text{(Eq-2)}$$

$$Pa + Px = 100 \quad \text{(Eq-3)};$$

[2] the concentration (Pa, % by mole) of the skeletal constituent derived from propylene (a) contained in the propylene random copolymer, and the melting point (Tm) measured with a differential scanning calorimeter satisfy the following relational expression (Eq-4):

$$135 - 4 \times (100 - Pa) < Tm < 165 - 4 \times (100 - Pa) \quad \text{(Eq-4)};$$

[3] the total amount of 2,1-bonded and 1,3-bonded non-stereoregular fractions is less than or equal to 0.2% by mole; and

[4] the amount of the n-decane (nC_{10})-soluble fraction is less than or equal to 2.0% by weight.

2. The propylene random copolymer according to claim 1, which has a melting point (Tm) of 140°C or lower.

3. The propylene random copolymer according to claim 1 or 2, wherein the propylene random copolymer is a propylene polymer particle having a trilayer structure consisting of a first skin layer [L1] that is present at the outermost crust, a second skin layer [L2] that is internally contacting with the first skin layer, and a core [L3] that is present inner to the second skin layer, and

in the transmission electron microscope (TEM) photograph (magnification ×4000) of an ultrathin section of the core [L3] after metal oxide staining, no stained component which has a particle diameter of 3 μm or greater is observed.

4. The propylene polymer particle according to claim 3, wherein the first skin layer [L1] is made of polyethylene, the second skin layer [L2] is made of a polypropylene having a melting point (Tm) of 130°C or higher as measured by DSC, and the core [L3] is made of a propylene homopolymer, or a copolymer obtained from propylene and at least one olefin selected from ethylene and an α-olefin having 4 or more carbon atoms.

5. The propylene polymer particle according to claim 4,

wherein the polyethylene of the first skin layer has an intrinsic viscosity [η] of 3 (g/dl) or greater and a density of 910 (kg/m^3) or greater, and the polypropylene of the second skin layer has an intrinsic viscosity [η] in the range of 0.5 to 5 (g/dl).

6. A method for preparing a propylene polymer wherein the following three processes [P-1], [P-2] and [P-3] are sequentially carried out in the presence of a metallocene catalyst:

Process [P-1]: Process for preparing a polymer precursor [P_1] by polymerizing ethylene.

Process [P-2]: Process for preparing a prepolymer [P_2] by polymerizing propylene in an amount of 50 to 20,000 g/g-cat in the presence of the polymer precursor [P_1] at a temperature of 5 to 40°C.

Process [P-3]: Process for preparing a propylene polymer [P_3] by homopolymerizing propylene or by copolymerizing propylene with at least one olefin selected from ethylene and an α-olefin having 4 or more carbon atoms in the presence of the prepolymer [B].

7. The method for preparing a propylene polymer according to claim 6, wherein the polymer precursor [P_1] prepared in the process [P-1] is washed with an aliphatic or alicyclic

hydrocarbon having 5 to 12 carbon atoms.

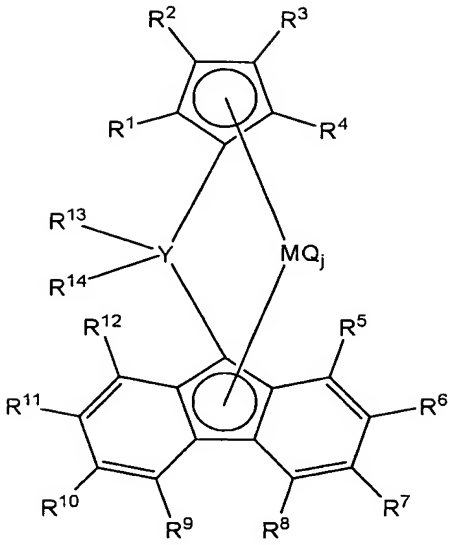
8. The method for preparing a propylene polymer according to claim 6, wherein at least one process selected from the process [P-1], process [P-2] and process [P-3] is carried out in the presence of a polyoxyalkylene compound represented by the following formula [I]:

$$R^1\text{-}O\text{-}[CH_2\text{-}CH(R^3)\text{-}O]_k\text{-}R^2 \qquad [I]$$

wherein R^1, R^2 and R^3 may be identical with or different from each other and are selected from a hydrogen atom, an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms and an acyl group having 1 to 20 carbon atoms; and k represents the average number of the repeating units and is in the range of 1 to 100.

9. The method for preparing a propylene polymer according to claim 6, wherein the process [P-2] is carried out in a tubular reactor.

10. The method for preparing a propylene polymer according to claim 6, wherein the metallocene catalyst contains a metallocene compound represented by the following formula [II] as an essential component:



wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13} and R^{14} may be identical with or different from each other and are selected from hydrogen, a hydrocarbon group and a silicon-containing group; M is a transition metal belonging to Group 4; Y is a carbon atom or a silicon atom; Q may be selected from halogen, a hydrocarbon group, an anionic ligand and a neutral ligand capable of coordination with a lone electron pair, combined in identical or different combinations; and j is an integer of 1 to 4.

11. The method for preparing a propylene polymer according to claim 6, wherein the propylene polymer is the propylene random copolymer according to any one of claims 1 to 5.

12. A molded product obtained by molding the propylene random copolymer according to any one of claims 1 to 5.

13. The molded product according to claim 11, which is a sealant film, a shrink film or a metal-deposited film.